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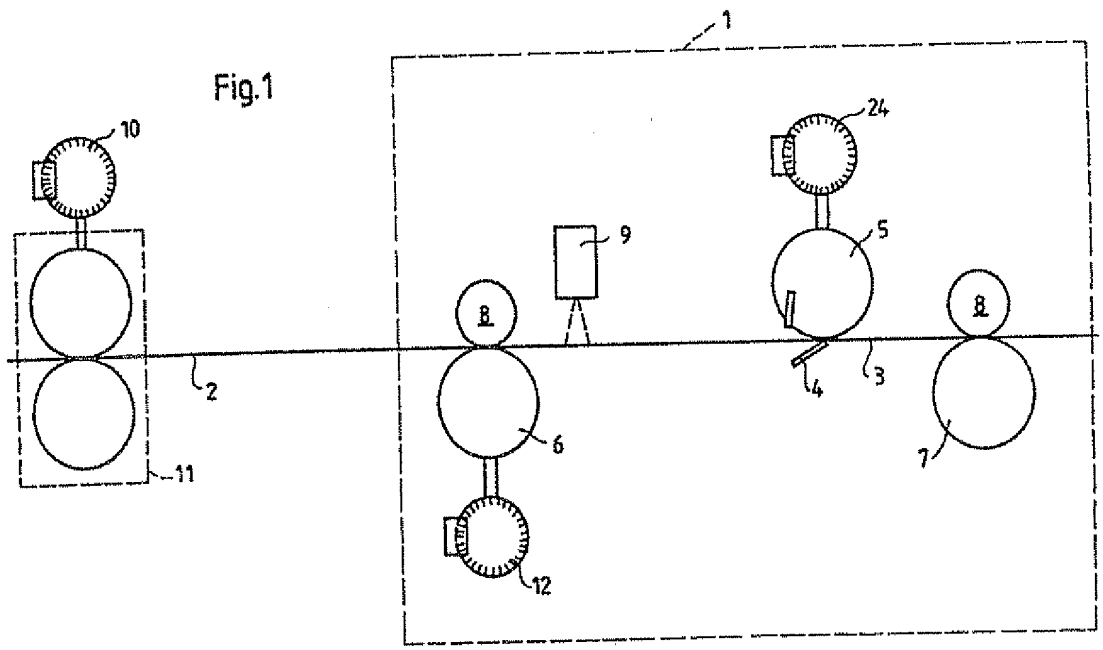
(54) **Cutter control for rotary printing press.**

(57) The invention relates to a cutting-register feedback-control device on cross-cutters of rotary printing presses. Markings on printing-unit cylinders are scannable by scanning apparatus (10), said scanning apparatus being connected, just like the similar scanning device (24) of a driven cutting cylinder (5), to a comparison and control circuit, said comparison and control circuit influencing positioning devices on printing-carrier webs in such a manner that corrections are made should there be angular deviations between printing-unit cylinders and cutting cylinder Said cutting-register feedback-control device is characterized in that, between rotary-position sensors (10, 12) of respectively a printing unit (11) and of web pulling apparatus (6), a control loop for a drive of the pulling apparatus (6) exists. This loop is independent of a control loop between rotary-position sensors (10, 24) of respectively the printing unit (11) and of a cutting cylinder (5) for a drive (23) of the cutting cylinder (5).

Fig.1



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1

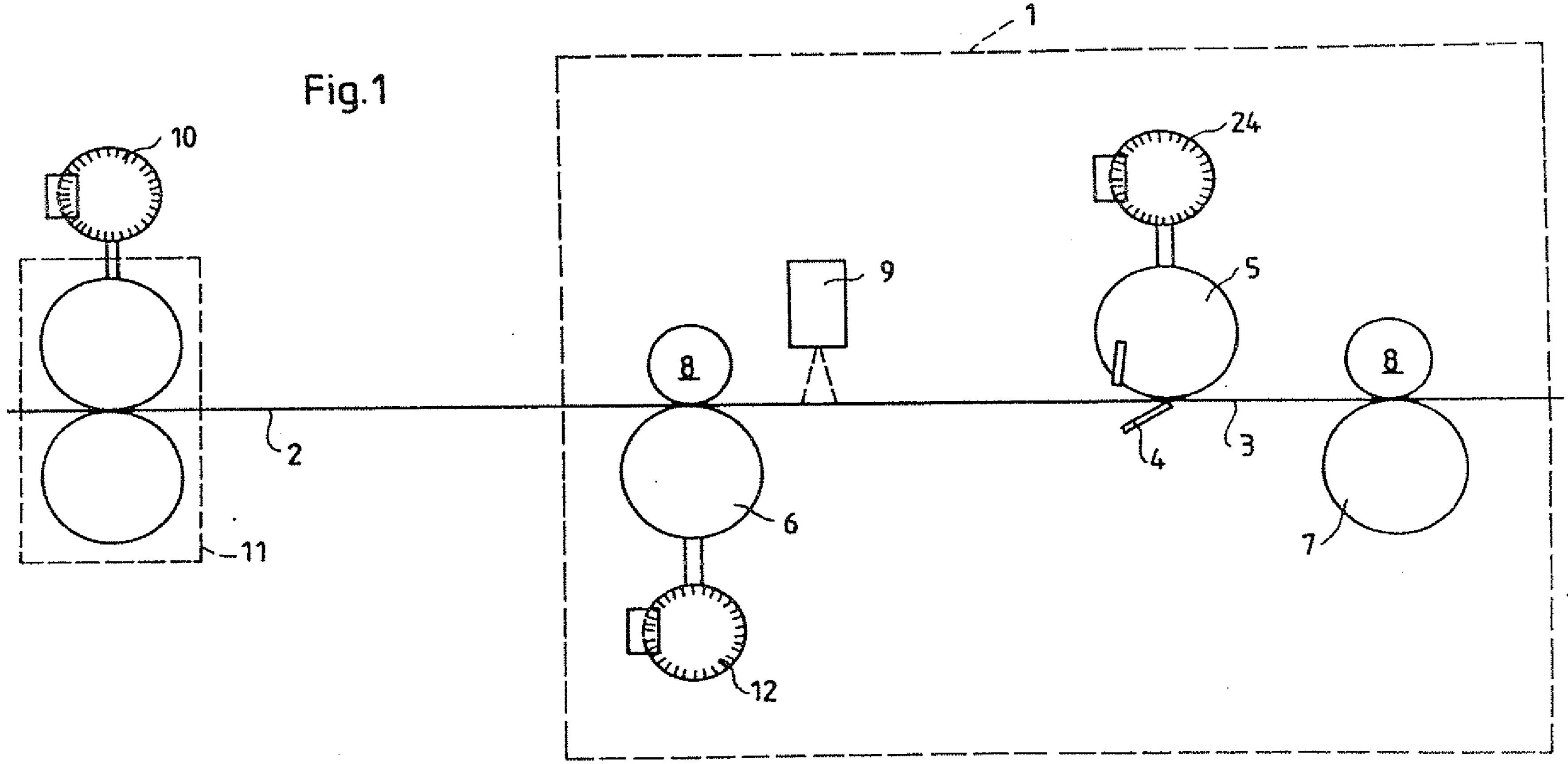

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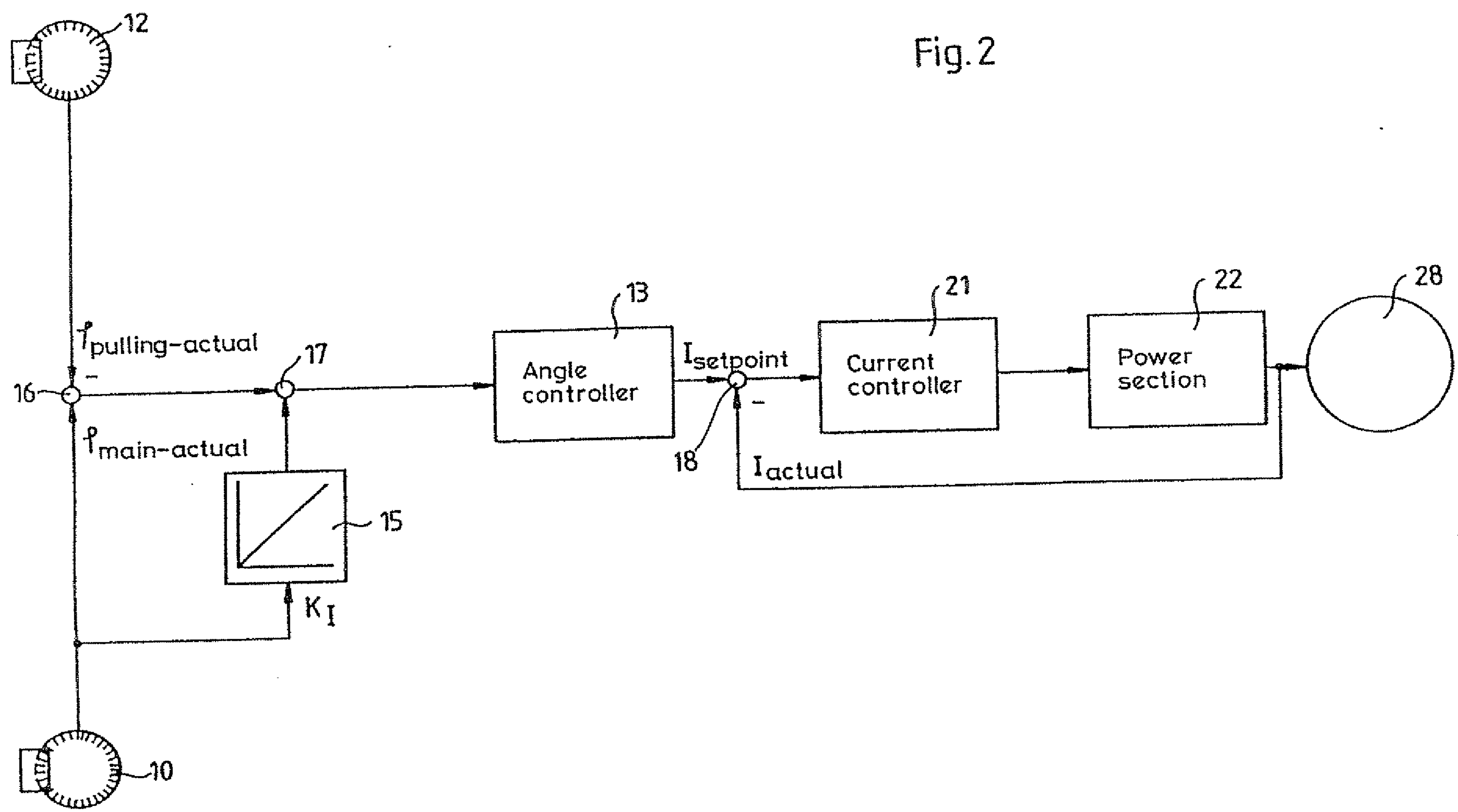
Fig. 2



12
10
16
17
15
K_I
$\varphi_{pulling\text{-}actual}$
$\varphi_{main\text{-}actual}$
13
Angle controller
$I_{setpoint}$
18
I_{actual}
21
Current controller
22
Power section
28

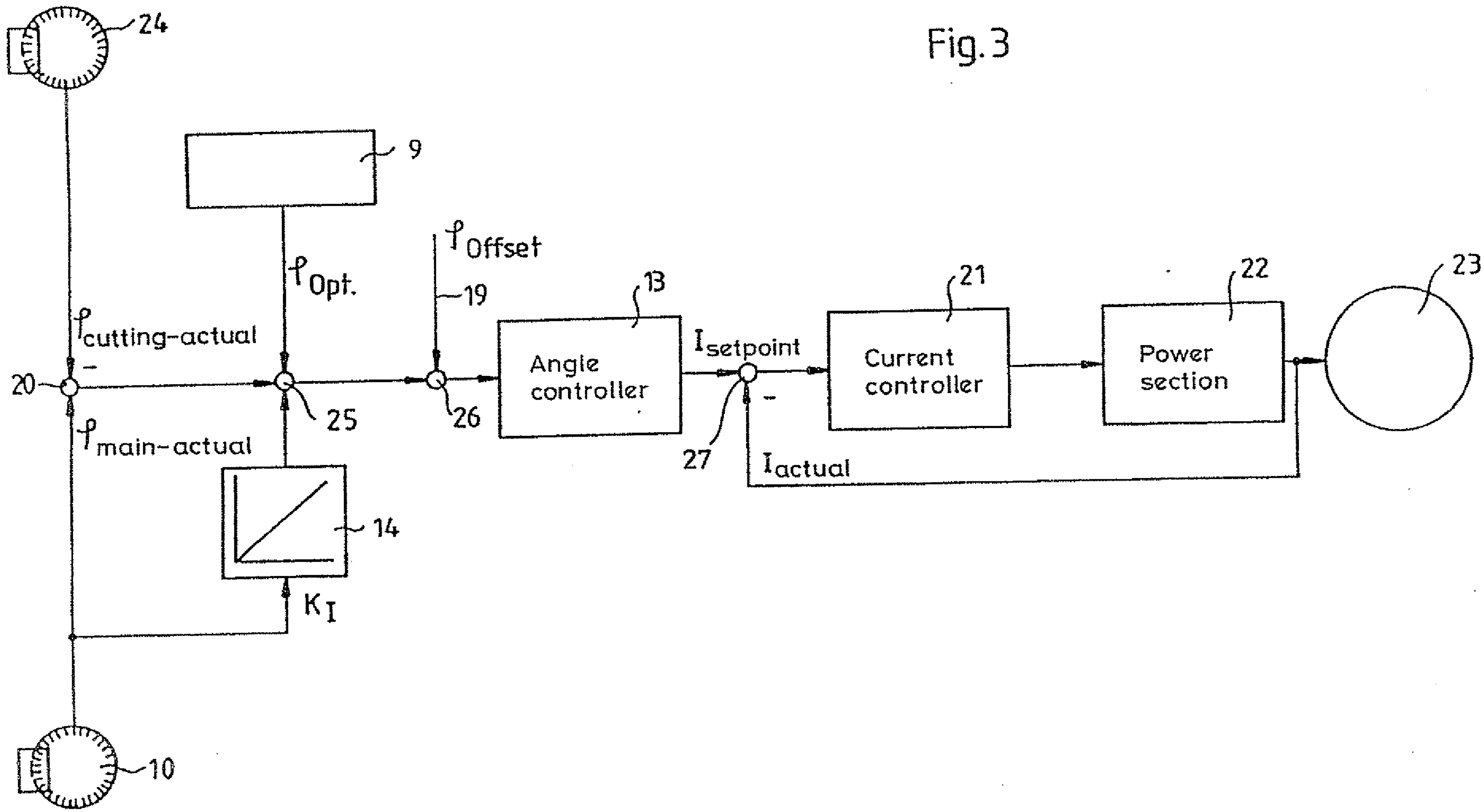

24
9
φ_{Offset}
19
$\varphi_{Opt.}$
13
21
22
23
$\varphi_{cutting-actual}$
–
20
25
26
Angle controller
$I_{setpoint}$
Current controller
Power section
$\varphi_{main-actual}$
27
–
I_{actual}
14
K_I
10

Fig. 3

Cutting-register feedback-control device on cross-cutters of rotary printing presses

The invention relates to a cutting-register feedback-control device on cross-cutters of rotary printing presses in which printing-carrier webs are printed, wherein markings on printing-unit cylinders are scannable by scanning apparatuses, said scanning apparatuses being connected, just like the scanning apparatus of a driven cutting cylinder, to a comparison and control circuit, said comparison and control circuit influencing positioning devices on printing-carrier webs in such a manner that corrections are made should there be angular deviations between printing-unit cylinders and cutting cylinder.

A cutting-register compensation device is known from the prior art, DE 36 02 894 C2. Two printing-unit cylinders, provided with markings, are scanned by scanning apparatuses and relay the pulses to a comparison and control circuit. Said comparison and control circuit, in turn, receives pulses from a scanning apparatus that is associated with a driven cutting cylinder. Depending on a comparison of the transmitted pulses, a web idler roller - pressure-medium-actuated in this case, for example - is deflected in order to correct the cutting register. There can be no talk in this case of a closed-loop control, since the drives of the printing-unit cylinder and of the cutting cylinder are not influenced in order to reduce the deviation towards zero. Using said cutting-register compensation device from the prior art, it is possible, by applying positioning apparatuses to the printing-carrier web, merely to vary the length of the web.

There is no disclosure of any influencing of the drive of web-transport pulling apparatuses.

Proceeding from the outlined prior art, the object of the invention is to operate a cross-cutting device, positioned after a rotary-printing press, without mechanical connection.

The object of the invention is achieved in that, between rotary-position sensors of a printing unit and of pulling apparatuses, a control loop for a drive of pulling apparatuses exists independently of a control loop between rotary-position sensors of the printing unit and of a cutting cylinder for a drive of the cutting cylinder.

The advantages of this design consist in the fact that there are two independent control loops, both using, as a common input variable, the absolute angular position of the printing-unit cylinder of the printing unit. With two independent control loops, the cutting register can be affected by varying the phase position of the cutting cylinder without influencing the rotational-speed-dependent web tension. With the aid of the control loops, the torques of the driving motors can be influenced in such a manner that, in spite of disturbance variables - such as fluctuations in paper quality - there is always the guarantee that the paper web will be correctly cut.

In a further development of the invention, positioned ahead of the cutting cylinder of an open-sheet delivery is a sensor for detecting the image position. By means of this optical sensor, it is possible, should there be a shift in the position of the printed image, to influence immediately an input variable of the control

loop for the cutting-cylinder drive, with the result that a precise cut always remains guaranteed.

According to the invention, a signal φ_{opt} of the sensor is supplied to the merged signals $\varphi_{cutting\text{-}actual}$ of the rotary-position sensor on the cutting cylinder and to the signal $\varphi_{main\text{-}actual}$ of the rotary-position sensor on the printing unit. Furthermore, the signal $\varphi_{main\text{-}actual}$ relayed from the rotary-position sensor of the printing unit is superimposed by a fixed difference signal. An input signal at a node is generated from the variables $\varphi_{cutting\text{-}actual}$ of the rotary-position sensor on the cutting cylinder, $\varphi_{main\text{-}actual}$ of the rotary-position sensor on the printing unit, the signal φ_{opt} of the sensor and the rotational-speed-dependent, ramp-like rising difference signal indicated by a proportionality constant K_r. Said difference signal permits the manufacture of products with a cut-off length divisible by a whole number. In addition, it is possible to effect a manual setting input φ_{offset}, which is important particularly during the start-up phase. The setting made during the start-up phase may, if necessary, be corrected during the production run.

Accordingly, an input variable for a signal converter is generated from the enumerated variables: $\varphi_{cutting\text{-}actual}$, $\varphi_{main\text{-}actual}$, φ_{offset}, φ_{opt} and the difference signal. The signal converter is followed by a control loop in which a current $I_{setpoint}$ is permanently compared with an actual current I_{actual}. The great advantage is that a signal composed of a multiplicity of input variables can be calculated with very great accuracy as an input variable in order then to serve as a precise reference variable for a current control loop. Consequently, an angle feedback-control system is

superimposed on the feedback control of the motor current.

The further subclaims relate to characterizing features of the control loop for the pulling apparatuses. Basically, said control loop guarantees the rotational-speed-dependently feedback-controlled maintenance of the tension of the material web being processed.

The present invention is described in greater detail with reference to the drawings, in which:

Fig. 1 shows a schematically represented printing-press arrangement consisting of upline-positioned printing unit and downline-positioned cross-cutter;

Fig. 2 shows a control loop for the drive of pulling apparatuses; and

Fig. 3 shows a control loop for the drive of a cutting cylinder.

The printing-press configuration shown schematically in Fig. 1 comprises an open-sheet delivery 1, ahead of which is positioned a printing unit 11 of a rotary printing press. In the printing unit 11, a material web 2 is printed on both sides and is cut into individual sections 3 in the open-sheet delivery 1 by a cutting cylinder 5, which cooperates with a position-fixed bottom knife 4. The material web 2 is transported by pulling rollers 6, with the transport of the sections 3 being accomplished by means of conveying rollers 7, which each cooperate with contact-pressure rollers 8 disposed opposite them. The cutting cylinder 5 and the pulling roller 6 each have their own drive. The

printing-unit cylinders of the printing unit 11 are associated with a rotary-position sensor 10; the angular position of the pulling roller 6 can be scanned through the intermediary of a rotary-position sensor 12, while the rotary position of the cutting cylinder 5, which is provided with at least one cutting blade, is scannable through the intermediary of a rotary-position sensor 24. A sensor 9 is disposed in front of the bottom knife 4 and the cutting cylinder 5 cooperating therewith, with it being irrelevant whether said sensor 9 is disposed above or below the material web 2 as it enters the open-sheet delivery 1.

Fig. 2 shows a control loop for the drive of pulling apparatuses.

A signal $\varphi_{pulling-actual}$ from a rotary-position sensor 12 of the pulling roller 6 is relayed to a signal node 16. A signal $\varphi_{main-actual}$ is likewise transmitted to the signal node 16 from the rotary-position sensor 10 of the printing unit 11. Following the merging of both signals, one of which has a negative sign, the resulting angle signal is relayed to a node 17. At the node 17, a further signal is added to the resulting signal. From the rotary-position sensor 10 of the printing unit 11, the signal $\varphi_{main-actual}$ is, firstly, relayed directly to the signal node 16; secondly, however, a rotational-speed-dependent, ramp-like rising difference signal 15, indicated here by a proportionality constant K_r, is added to $\varphi_{main-actual}$. The addition of the difference signal 15 is effected in rotational-speed-dependent manner, with the result that the slope of the characteristic shown in Fig. 2 reflects merely the curve of one characteristic from a family of characteristics.

The signal calculated at the node 17 from the signals $\varphi_{pulling-actual}$, $\varphi_{main-actual}$ and $\varphi_{main-actual}$ modified by K_r represents the input variable, which is supplied to a signal converter 13, where an input signal is converted into an output signal, a current $I_{setpoint}$ corresponding to the calculated angular deviation. Through the intermediary of a current controller 21, which controls a power section 22, the motor torque of a drive 28 is controlled by the current $I_{setpoint}$. The actual current I_{actual} is returned to a signal node 18, with a negative sign. If the deviation between $I_{setpoint}$ and I_{actual} is equal to 0, then ideal conditions pertain. If, on the other hand, an angular error is detected through the intermediary of the rotary-position sensors 10 and 12, a current $I_{setpoint}$ suitable to compensate for said angular error is computed and matched through the intermediary of the current controller 21, with the motor driving torque of the drive 28 thus being influenced immediately. In this manner, a web tension dependent on the rotational speed of the printing-unit cylinders of the printing unit 11 is maintained, with interference variables being correctly immediately.

Fig. 3 shows a control loop for the drive of a cutting cylinder.

From the rotary-position sensor 24 of the cutting cylinder 5, a signal $\varphi_{cutting-actual}$, indicating the actual rotary position of the cutting cylinder 5, with negative sign, is transmitted to a node 20. A signal $\varphi_{main-actual}$ from the rotary-position sensor 10 of the printing unit 11 is, firstly, supplied to the node 20 and, secondly, depending on signal $\varphi_{main-actual}$, a rotational-speed-dependent difference signal 14, indicated here by a proportionality constant K_r, is

formed. In this case, for example, the characteristic of the difference signal 14 as shown in Fig. 3 is more closely characterized by the proportionality factor K_I. At the node 25, a signal φ_{opt} of the sensor 9 is superimposed on the rotational-speed-dependently calculated difference signal 14, the signal $\varphi_{cutting-actual}$ and the signal $\varphi_{main-actual}$. The sensor 9 detects any occurring shift in position of the printed image on the material web 2 - for example as a result of fluctuations in paper quality. Consequently, four input signals are merged at the node 25; the result of the merging is relayed to the node 26. In generalized terms, it is true to say that the signals already included at the node 25: $\varphi_{cutting-actual}$, $\varphi_{main-actual}$, φ_{opt} and the rotational-speed-dependent, ramp-like difference signal 14 (formed as a function of the printing-press speed $\varphi_{main-actual}$) are continuously transmitted during the production run and are thus available as input variables for angular feedback control. This is not true of the setting input 19 φ_{offset}. When the printing-press configuration is being set up, φ_{offset} is inputted by the printer such that the cut-off is at the border of a printed section. Once, after production has run up to speed, a steady state has become established, φ_{offset} becomes irrelevant; feedback control takes place automatically on the basis of the aforementioned input variables.

The signal that is supplied to the signal converter 13 is generated at the node 26; depending on the input signal of the calculated angular deviation, a current $I_{setpoint}$ is computed, said current $I_{setpoint}$ being relayed via a current controller 21 to a power section 22, which, in turn, influences the motor torque of the drive 23 of the cutting cylinder 5. The actual motor current I_{actual} is returned to a node 27. If the

deviation is 0, there is no need for feedback control. Only in the case of signals from the sensor 9 indicating a shift in the position of the printed image, or in the case of differences in the signals $\varphi_{cutting-actual}$ and $\varphi_{main-actual}$ is there a change in the input variable supplied to the signal converter 13 from the node 26. In this case, the motor current $I_{setpoint}$ is suitably changed, which results in a change in the motor torque of the drive 23 of the cutting cylinder 5. This, in turn, displaces the cutting position between cutting cylinder 5 and bottom knife 4 with respect to the moving material web 2. Through the use of a high-resolution sensor 9, it is possible, in spite of disturbance variables such as fluctuations in paper quality, for the cutting register to be kept within the tenths-of-a-millimetre range.

Two independent control loops for the drives 23 and 28 permit the maintenance of a rotational-speed-dependent web tension without adversely affecting the accuracy of the cut-off. The accuracy of the cut-off, in turn, is not diminished by fluctuations in paper quality, since the sensor 9 immediately detects any shift in the position of the printed image and influences the input variable of the control loop of the cutting-cylinder drive 23.

It will of course be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

CLAIMS :

1. Cutting-register feedback-control device on cross-cutters of rotary printing presses in which printing-carrier webs are printed, wherein markings on printing-unit cylinders are scannable by scanning apparatuses, said scanning apparatuses being connected, just like the scanning apparatus of a driven cutting cylinder, to a comparison and control circuit, said comparison and control circuit influencing positioning apparatuses on printing-carrier webs in such a manner that corrections are made should there be angular deviations between printing-unit cylinders and cutting cylinder,
c h a r a c t e r i z e d i n t h a t
between rotary-position sensors (10, 12) of a printing unit (11) and of pulling apparatuses (6), a control loop for a drive (28) of pulling apparatuses (6) exists independently of a control loop between rotary-position sensors (10, 24) of the printing unit (11) and of a cutting cylinder (5) for a drive (23) of the cutting cylinder (5).

2. Cutting-register feedback-control device on cross-cutters according to claim 1,
c h a r a c t e r i z e d i n t h a t
positioned ahead of the cutting cylinder (5) of an open-sheet delivery (1) is a sensor (9) for detecting the image position.

3. Cutting-register feedback-control device on cross-cutters according to claim 2,
c h a r a c t e r i z e d i n t h a t
a signal φ_{opt} of the sensor (9) is supplied to superimposed signals $\varphi_{cutting\text{-}actual}$ of the rotary-

position sensor (24) on the cutting cylinder (5) and to a signal $\varphi_{main-actual}$ of the rotary-position sensor (10) on the printing unit (11).

4. Cutting-register feedback-control device on cross-cutters according to claim 1, c h a r a c t e r i z e d i n t h a t dependent on the signal $\varphi_{main-actual}$ relayed from the rotary-position sensor (10) of the printing unit (11), a rotational-speed-dependent difference signal (14) is calculated.

5. Cutting-register feedback-control device on cross-cutters according to claims 3 and 4, c h a r a c t e r i z e d i n t h a t an input signal of a node (26) is formed from the variables $\varphi_{cutting-actual}$ of the rotary-position sensor (24), $\varphi_{main-actual}$ of the rotary-position sensor (10) and the signal φ_{opt} of the sensor (9) and the rotational-speed-dependently calculated difference signal (14).

6. Cutting-register feedback-control device on cross-cutters according to claims 3, 4 and 5, c h a r a c t e r i z e d i n t h a t the phase position of the cutting cylinder is manually preselectable as a setting input (19) φ_{offset}.

7. Cutting-register feedback-control device on cross-cutters according to claim 1, c h a r a c t e r i z e d i n t h a t a current I_{actual} of the drive (23) of the cutting cylinder (5) is returned to a node (27), said node (27) being positioned after a signal converter (13).

8. Cutting-register feedback-control device on cross-cutters according to claim 1,
c h a r a c t e r i z e d i n t h a t
a signal to be supplied to a node (17) is generated from a signal $\varphi_{\text{pulling-actual}}$ of the rotary-position sensor (12) and from the signal $\varphi_{\text{main-actual}}$ of the rotary-position sensor (10).

9. Cutting-register feedback-control device on cross-cutters according to claim 8,
c h a r a c t e r i z e d i n t h a t
a rotational-speed-dependent, rising difference signal (15) is superimposed on the signal $\varphi_{\text{main-actual}}$ relayed from the rotary-position sensor (10).

10. Cutting-register feedback-control device on cross-cutters according to claims 8 and 9,
c h a r a c t e r i z e d i n t h a t
a signal calculated at a node (17) is supplied to a signal converter (13), said signal converter (13) being followed by a node (18) to which is returned a current I_{actual} of a drive (28) of the pulling apparatuses (6).

11. A cutting-register feedback control device substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -12-	Application number GB 9323196.7
Relevant Technical Fields (i) UK Cl (Ed.L) B6C: CBAK, CWD, CWH, CWK; B8R: RRA8 (ii) Int Cl (Ed.5) B41F: 13/60, 19/00, 33/00	Search Examiner A DAVEY Date of completion of Search 9 DECEMBER 93
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE: WPI	Documents considered relevant following a search in respect of Claims :- 1-11

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